Light and Lighting

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Waste of Light

IT is very proper, in these times of scarcity, that *waste of light*, in the sense of light misused should be frowned upon.

Efficient equipment should be substituted wherever possible, for lamps and fittings of bad design or imperfectly maintained, which consume too much gas or electricity for the light yielded. Paragraph 2b(ii) of the Waste of Fuel Order explicitly mentions this condition as a form of "waste of light." It is therefore a ground on which action could be taken, just as in the case of extravagant display of light.

We doubt very much whether, in present circumstances, much light is being wasted in the form of display, or is being used in quantity excessive for the purpose in view. It is possible to make some saving in fuel by deprivation of light, but the possible economy that can thus be achieved is small, and such deprivations must be paid for—in loss of safety, convenience, or comfort.

If, however, reductions *must* be made, let it be clearly indicated what is expected. The recent case of the Strand Palace Hotel (see p.112) shows the pitfalls awaiting an observer who relies only on personal impressions. No doubt the authorities will now avoid such difficulties by stating the consumption of gas or electricity that may reasonably be permitted for lighting purposes.

More Light on Bus Platforms

It is stated that the number of accidents to people alighting from trams and buses during the blackout is giving concern to the authorities, and that the illumination on the platforms is accordingly to be increased. This is a welcome concession—especially at a moment when, in the interests of fuel economy, still further diminutions in interior lighting are being enforced or encouraged. It is well to remember, however, that the number of street accidents, due to this particular cause, probably forms but a small fraction of the total fatal accidents to pedestrians during the blackout (nearly 1,800 during the period September, 1941, to May, 1942). After three years' experience, during which some lessons have surely been learned, would it not be worth while to explore the possibility of some slight general concessions to greater visibility in the streets?

Ploughing by Night

In order to get the bulk of the acreage sowed by the end of October ploughing will have to be continued during the hours of darkness. Experiments conducted by the Ministries of Agriculture and Home Security have shown that straightforward ploughing can be done by the aid of a pair of masked motor headlamps shedding light in front and behind. The lamps must comply with Par. 17 of the Lighting (Restrictions) Order 1940, except that the beam may be directed downwards at any convenient angle. This will obviously involve a second shift, and it is suggested that extra drivers should be trained at once to operate under night conditions.

U.S.A. Blackouts

Blackout requirements in America naturally differ from those here. A recent specification issued by the U.S.A. War Department suggests the reduction of interior lighting as an alternative to complete obscuration of windows. These conditions assume the use of special blackout incandescent lamps or of shades which shield the light from outside observation above the horizontal in an approved manner. Elsewhere in *Illuminating Engineering*, from which this information is derived (July, 1942), there is a contribution by Davis M. de Bard entitled "England—its Lighting in Wartime." This constitutes a concise but comprehensive survey, within the space available.

Light Furniture and Surroundings

A short time ago (July, 1942, p. 85) we commented upon the desirability of painting bulky machinery in factories a light colour so as to aid diffusion of light and produce relatively light backgrounds. It was then mentioned that a lighter tint of "machine tool grey" is to be adopted in the United States. We now notice that in the same country Dr. Parry Moon has been studying this question in relation to rooms generally. In schools and offices, where furniture takes the place of machines, the same principles apply. Thus it is advocated that the reflection factors of desk tops should be at least 0.40 (instead of 0.06 to 0.14 as is usual), and that steel filing cabinets should be finished in lighter colours. The author also suggests that the interior surface of Venetian blinds should be white. The same, of course, applies to black-out curtains, which are too often funereal, without inner light-coloured lining. It is possible that not all will agree with the author in suggesting that both walls and ceilings should be white, not ivory or cream, and that floors should have relatively high reflecting factors (0.50 is regarded as quite practicable). Whilst white is admittedly desirable for ceilings light buff or green is usually preferred for walls on the ground that white walls are apt to appear "staring" besides showing the dirt too quickly. The drawback of very light colours for floors, which, as regards cleanliness, are the most vulnerable of all surfaces in rooms, is evident. Yet the advantages of upward reflection of light are very definite and too great to be overlooked. In artificially lighted rooms such upward reflection helps very greatly to relieve sombreness of surroundings and diminish the tendency to "tunnel effect."

The "psychological value" of light surroundings, and the resultant softening of shadows and alleviation of glare are often emphasized, but the *physical* gain, in the form of increased illumination, is apt to be overlooked. The extent of this gain is most evident with indirect lighting; but even when general diffused lighting is adopted extreme variations in the surroundings may more than double the utilisation factor. It was shown long ago that the illumination derived from an amount of light emitted and evenly distributed would be multiplied by $1/1-k$, where k is the coefficient of reflection of the surroundings. If k were unity (i.e. the reflection 100 per cent.) the increase in illumination would be infinite. If k attained 0.95 (a value actually exceeded in some materials for coating the insides of integrating spheres) the light would be increased 20 *times*. Such values cannot be approached in daily life. The calculation shows, however, the advantage, in connection with artificial lighting, of getting a high *average* reflection factor, not only for walls and ceilings but also for furniture, floor and other objects. (There are, of course, other considerations—for example, that if light surroundings are adopted objects in a room (chairs, tables, etc.) should be fairly dark so as to stand out in contrast to them.)

In dealing with natural lighting there is also some danger that the importance of light surroundings may be underestimated. Designers are preoccupied with daylight factors and the direct daylight entering rooms. They are apt to disregard the reflected component of the light, on which portions of room remote from the window so greatly depend. In city streets all rooms but those on the highest floors may receive their daylight exclusively by reflection from buildings opposite. The influence of such light striking *upwards* on to walls and ceilings may be considerable.

Fluorescent Store Lighting

We are indebted to *Signs* for the above examples of modern store illumination in America. It will be observed that fluorescent lighting figures boldly in the design, and this will doubtless become a familiar feature in post-war shops. This is one of several designs selected by Victor Gruenbaum, the New York designer, who emphasises the great importance of design in determining the volume of trade. In this Los Angeles store a glass wall between the arcade and the sales room gives a full view of the latter from the street. Of special interest is the combination of luminous tubing with the circular panels on the right, which help to produce a balanced effect and remove any impression of monotony.

Continuous tube fluorescent lighting is now being standardised in the United States, mainly by the aid of the newly formed Fluorescent Lighting Association in New York City. The Association has under way the standardising of fluorescent colours and in particular the so-called "3,500 white." "Tailored tubing" is the aim, so that it can be fitted together to meet any desired conditions and readily assembled locally. Experience has shown that, after the first 100 hours of "breaking in," results are remarkably constant and the average installation can readily carry a 5,000 hour or one year guarantee.

The Association is co-operating with Government authorities with a view to the utilisation of this form of lighting in war production plants. It remains to be seen how far the entry of the U.S.A. into the war will check further development on the commercial and spectacular side, but enough has already been done to indicate future possibilities.

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I.E.E. London Students Section

The London Students' Section of the Institution of Electrical Engineers is now beginning its new session. The officers for the session 1942-43 are:—*Chairman*, G. M. Childs; *Vice-Chairman*, J. D. McNeil; and *Hon. Secretary*, G. C. Barnes, 9, Cranley-road, Ilford, Essex. Mr. H. Shoreland has been elected *Hon. Asst. Secretary*.

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Personal

We are informed that Mr. M. C. Toner, of Holophane, Ltd., has secured an appointment as technical journalist with the Ministry of Supply in London. Mr. Toner has a long standing association with Holophane, Ltd., in connection with lighting development and publicity, and has been an active member of the I.E.S., first in London and subsequently in Sheffield, where he has had special opportunities of studying the lighting requirements of the textile industry.

What Constitutes Waste of Light?

As reported in our last issue (*Aug., 1942, p.99*), action was recently taken against certain hotels and theatres under the Waste of Fuel Order, 1942. The summons against the Strand Palace Hotel, for whom Mr. R. O. Ackerley appeared as expert witness, was dismissed. This case is of interest because this is believed to be the first occasion on which the I.E.S. Code was presented as evidence in a legal action. In what follows we therefore give a summary of the proceedings.

Of the various actions arising in connection with the Waste of Fuel Order, 1942, that which came before Sir Bertram Watson, the Chief Metropolitan Magistrate, at Bow-street Police Court on August 12 is of special interest, first, because of the references to the I.E.S. Code and the use of readings of illumination photometers in evidence, and, secondly, because of the illustration of the need to distinguish between the illumination provided and the apparent brightness of the sources of light.

It may be helpful if, at the outset, it is explained that the lighting conditions under consideration were those (1) over the foot of the main staircase, leading out of the entrance hall, the light coming mainly from a moulded glass surround to the staircase arch, (2) on the service counter at the soda fountain, provided mainly by a luminous surround at the back. It will be noted that in both cases the lighting serves several purposes, possibly partly decorative, but also utilitarian.

Alleged Waste of Light.

In opening the proceedings Mr. L. A Byrne, who appeared as counsel for the prosecution, referred to the visit of two enforcement officers to the Stand Palace Hotel on July 14. A tobacco kiosk and a theatre ticket agency in the lounge, and also the frame formed by the entrance were "brilliantly illuminated." In the winter garden, in addition to the usual ceiling lighting, the soda fountain was framed in light with two lamps on the counter.

Mr. Michael Woods, one of the enforcement officers, examined by Mr. Byrne, referred to these conditions, which were held to constitute waste of light, and reported coversations with the manager and the electrician (Mr. Rundle).

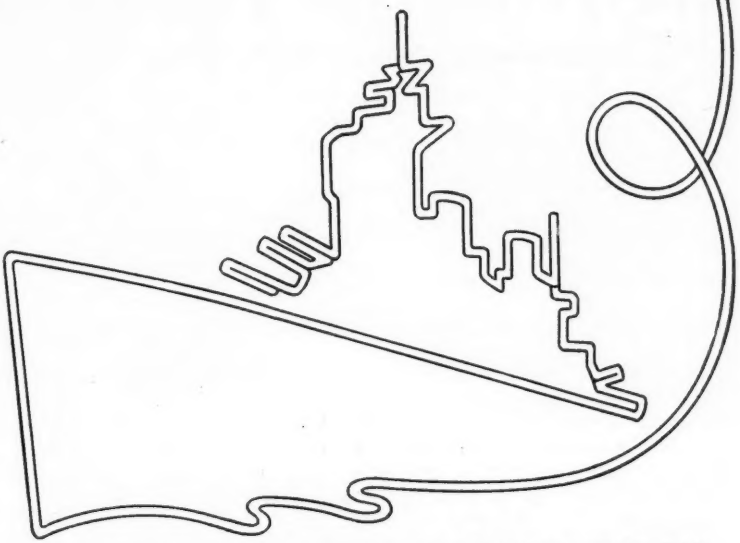
No Measurements Made

Mr. G. D. Roberts, K.C., who appeared for the defence, then cross-examined Mr. Woods and drew from him the admission that his judgment was based on observation only, that he made no test and was unaware of the I.E.S. Code. Mr. Woods, before leaving the box, agreed, in response to a query by the magistrate that he had no specialised knowledge of electric light and did not measure in any way the amount of electric light being used.

Mr. L. H. R. Rundle, the chief engineer of the Strand Palace Hotel, explained the nature of the lighting on July 14, when the two inspectors called, and the experimental reductions made as a result, which were in use until July 31. The lighting was reinstated because the amount thus reduced was found to be insufficient for carrying on business. For example, people ascending the staircase were colliding with those descending, and those standing in the vicinity of the arch were unable to read. The witness also referred to the visit of Mr. R. O. Ackerley, who was shown the original lighting and took full measurements.

I.E.S. Code Quoted

Mr. R. O. Ackerley, in evidence, stated that he was manager of the illuminating engineering department of the General Electric Company and President-Elect of



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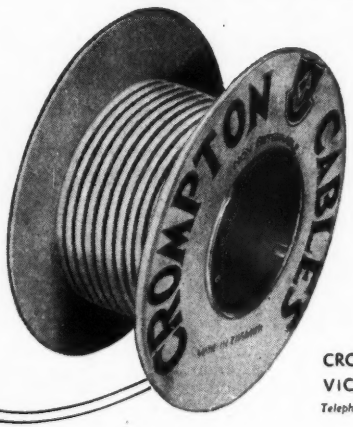

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the Illuminating Engineering Society. He exhibited the illumination photometer with which measurements had been made. Examined by Mr. Roberts, he stated that the I.E.S. Code was recognised as the only existing Code for sound practice, and had been adopted by Government Departments as a standard. The value prescribed in the Code for hotel staircases was 2 to 4 ft.c. Copies of the Code were handed to counsel.

Results of Tests

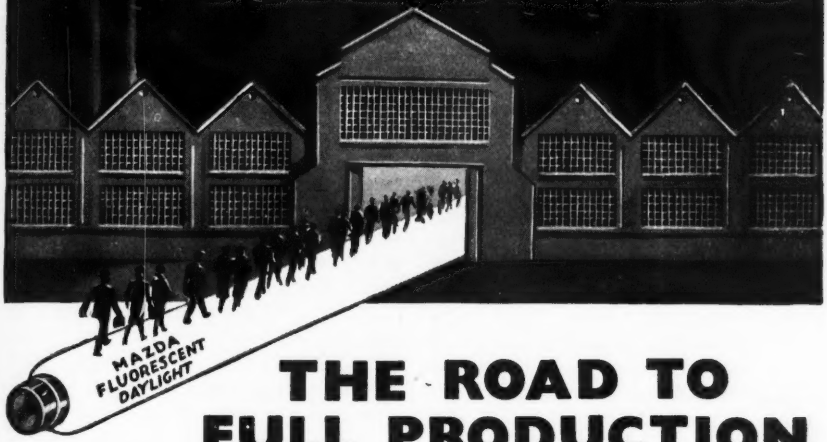
The average measured illumination at the foot of the stairs, with the reduced lighting, was 1.1 ft.c. The value with the lights in the condition as seen by the inspectors was just under 3 ft.c. In the hall the value was 2.5 ft.c. On the table beside the soda fountain, where food and drink was prepared, the average was 3.75, whereas in a factory devoted to similar work 10 to 15 ft.c. was considered necessary, and the actual minimum according to the factory regulations was 6 ft.c. In response to an enquiry from the Magistrate, Mr. Ackerley agreed that there was no waste of electricity. If they had cut down the existing illumination they would have had insufficient lighting.

Mr. Ackerley, when cross-examined by Mr. Byrne, who discussed the effect of the panel lighting, agreed that a more efficient form of lighting could be put in. Subsequently, re-examined by Mr. Roberts, he agreed that the present lighting system dated back for years before the Waste of Fuel Order. If he were given *carte blanche* he could reorganise the lighting and burn less electricity, but in his opinion no light was being wasted and the illumination furnished was not excessive. The instrument used was a modern and up-to-date one.

The Decision

At this point the Magistrate gave his decision. The one witness for the prosecution had quite frankly and fairly admitted that he had not any specialised knowledge of electric lighting or illumination and no special experience of it. This was insufficient to warrant a conviction upon this summons, which was therefore dismissed.

B T H LIGHT-CONDITIONING



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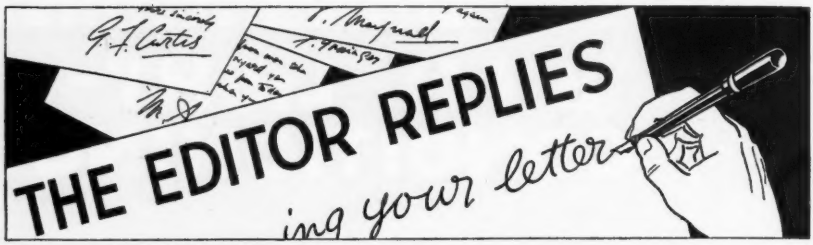


Letters continue to reach me about the **Fluorescent "Daylight" Lamps.** One correspondent, who gives his impressions as a machine-shop inspector in a munitions factory, agrees with others he has consulted, in regard to certain advantages, e.g., the ease with which defects can be seen and the helpfulness of the almost shadowless effect.

On the other hand, complaint is made that "the intenseness of the light is upsetting to the eyes," and especially so when making close inspections of highly-polished or ground surfaces. The description "intense" obviously does not apply to a source of such low brightness, and this my correspondent concedes. Nevertheless, he feels that there is an **"elusive something"** which is upsetting. It is, of course, difficult to analyse the origin of discomfort so vaguely described. It may possibly be associated with the fact that although the brightness is low the candlepower is considerable, so that even this source operates best when mounted at a relatively high level, out of the immediate range of view.

One cannot help feeling, however, that **lighting is often made the scapegoat for other defects.** Continuous work in a factory at high pressure is apt to prove trying, whatever the form of lighting may be, and especially so to middle aged and elderly men who form a larger proportion than in normal times, and whose eyesight may be in some degree imperfect. Furthermore, close inspection of polished surfaces is in itself somewhat fatiguing—but would presumably be even more so if source of much greater brightness, such as the filament of a tungsten lamp, were in use.

Another objection is based on **the initial flicker** when fluorescent lamps are first switched on. This will doubtless be eliminated in course of time, but in any event it should only prove irritating when lamps are being constantly switched on and off—surely an unusual condition.

My attention has been drawn to Mr. Ward Harrison's suggestion that 0.0002 ft.c., which has been adopted in this country for war-time street lighting, and is approximately equivalent to starlight, should be described as **"Standard Starlight Illumination (S.S.I.)** *Illuminating Engineering*, April, 1942, p. 205). Higher values, he suggests, should be treated as multiples of this. (Thus 0.02 ft.c. would be 100 S.S.I.).

This seems to be a reasonable proposal. There is no need to be meticulous in tracing the origin of this description in terms of starlight. So far as we

recall the term has not been officially adopted at present in this country. Like Topsy, it "just growed," and "synthetic starlight" was adopted in the Press as a description of war-time street lighting when it was first introduced.

In connection with my recent remarks on **the "black-in problem,"** which arises when people enter the dense obscurity of underground passages to underground premises during the daytime, I have been asked what artificial illumination ought to be provided immediately inside the light lock in order to obviate danger. When the top of the stairway is open to daylight the problem is not acute, and for A.R.P. reasons, the artificial illumination in its vicinity is necessarily low. When the lightlock is only partial, i.e., daylight is not completely excluded, conditions are also not too bad. The real trouble arises when daylight is completely cut off, for in these circumstances one may step from full sunlight (say up to 5,000 ft.c.) into the very low order of illumination prevailing in underground premises just now, probably a fraction of a foot-candle.

It is usually held that the worst results of excessive contrast are avoided if the ratio does not exceed 100 : 1. This would mean an interior illumination at the top of the staircase of about 50 ft.c., which would no doubt be considered excessive at the present moment. If, however, 10 or even 5 ft.c. were provided giving a 100 : 1 ratio with 1,000 and 500 ft.c. outside, this would go far towards removing the disability in all but the brightest daylight, especially if the surroundings were whitewashed. It is not unreasonable to suggest such a value as this, which would only be needed immediately inside the entrance and would diminish gradually as one proceeded downstairs into Stygian conditions.

I have been asked to explain why the **upper region of a window is most valuable** for admission of daylight. This is a tall order, in the space available. The first and most obvious reason is that any direct skylight visible usually comes through the upper parts of windows. But, even if the whole window area were occupied by sky or some other surface area of uniform brightness, the light coming from the top of the window would still be most valuable at the back of the room, where it is chiefly needed. This is mainly because it strikes the table at a less oblique angle and is thus most effective in producing an adequate illumination on a horizontal surface, such as a desk or table. Further, more light coming very obliquely gives rise to troublesome shadow conditions. For both reasons any additional illumination obtained from walls and ceilings by reflection is most valuable in these remoter parts of the room.

It is, therefore, an accepted principle that windows should run right up to the ceiling wherever possible. On the other hand one should not apply this idea too slavishly. If, for example, windows in a factory are largely blacked out and only a part of the window area can be left free during the daytime, it might not be good policy to expose **only** the upper parts of windows. Illumination is specially needed on the benches running round a room and windows adjacent to them are therefore left free when possible. Again, to take an extreme example, if a prisoner in a cell were offered the choice between a small window high up near the ceiling and one near eye level there is no doubt that he would prefer the latter—even if the view from the window had nothing to recommend it.

Literature on Lighting

(Abstracts of Recent Articles on Illumination and Photometry in the Technical Press)

(Continued from p. 94, July, 1942)

GENERAL PHYSICS AND RADIATION

74. The Rôle of Photography in the Detection and Measurement of Radiation. E. R. Davies. Phot. J., Vol. 82, p. 267, July, 1942. (Lecture delivered to London Branch of the Institute of Physics.) Modern theory of the physics of the photographic image is outlined, and the application of this knowledge to photographic photometry discussed. [Abstractor's note: A very lucid account of modern latent image theory is given in sufficient detail for all but the specialist in this branch of physics.] R. G. H.

75. The Colour of Light on the Projection Screen. M. R. Null, W. W. Lozier, D. B. Joy. J. Soc. Mot. Pict., Eng., Vol. 38, p. 219, March, 1942. Spectral energy distribution measurements of the light at the centre of the screen for a number of arc lamps and carbon combinations in common use show that the curves obtained compare closely with black body curves. R. G. H.

76. Uses of U.V. Radiation. J. R. Harris. Elec., 129, p. 39, July 10, 1942. A brief description is given of the three main divisions into which U.V. radiation may be placed, together with details of the uses to which such radiation is put in practice. C. A. M.

77. Infra-Red Radiation. A. E. Tooke, H. W. C. Gatehouse. El. Rev., Vol. 130, pp. 137 and 169, Jan. 30 and Feb. 6, 1942. The development of near infra-red radiating plant for rapid drying of paintwork is described, with photographs and diagrams. Examples of installations are given. R. G. H.

78. Infra-Red Heating. E. E. Ackland. Elec., 129, pp. 108-109, July 31, 1942. A review is given of a paper by the author dealing with developments in Canada in infra-red heating. A new coiled coil lamp for this purpose with a cherry-red glow (about 2,000° K.) is mentioned. C. A. M.

PHOTOMETRY

79. A System of Photometric Concepts. Parry Moon. Jour. Opt. Soc. of America, Vol. 32, No. 6, June, 1942. The author discusses in detail a new system of photometric concepts and nomenclature designed to bring the quantitative treatment of photometric subjects into line with that of other physical quantities. The new system is based on three fundamental quantities or dimensions of flux, distance and time. H. J. T.

80. A Graphical Method of Determining Lighting Costs. L. S. Ickis. Am. Illum. Eng. Soc. Trans., 377-381, June, 1942. Graphical methods of determining the annual charges on capital cost, the energy cost and the lamp cost for an installation are given. J. S. S.

LIGHTING EQUIPMENT

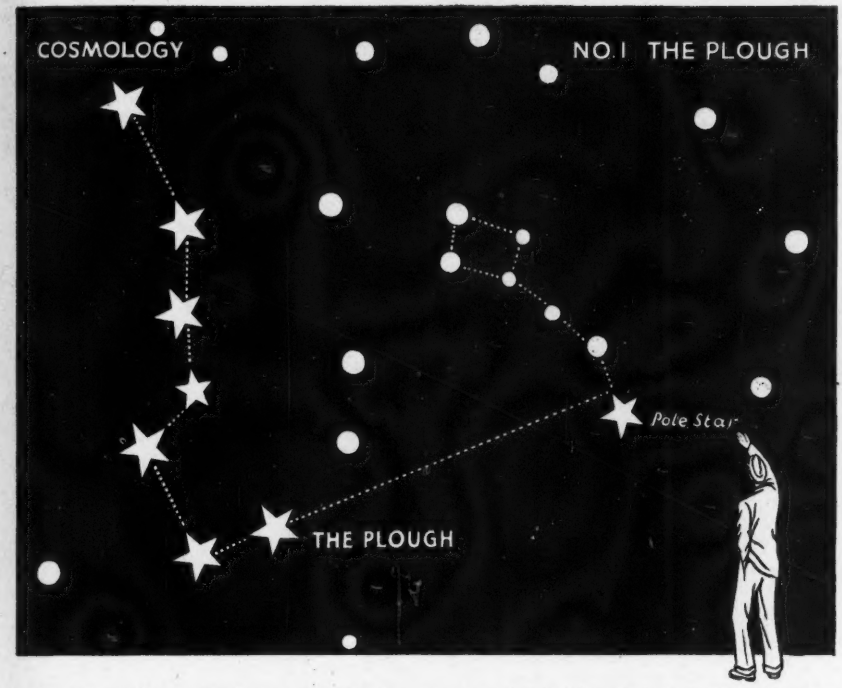
81. Opal Lighting Fittings. S. English. El. Rev., Vol. 130 p. 722, June 5, 1942. (Presidential Address to Society of Glass Technology.) The considerations, such as glare and uniformity of brightness, governing the production of opal glass fittings are given, and future possibilities open to English glass manufacturers discussed. R. G. H.

82. New Fittings for Fluorescent Tubes. Anon. Elec. Times, Vol. 102, 2650, Aug. 6, 1942. A brief description of some new industrial type fittings for fluorescent tubes is given. The fittings have open tops which tend to mitigate the "tunnel effect" in lighting. W. E. H.

83. Non-Reflecting Glass. Anon. Review of Scientific Instruments, Vol. 13, 6, June, 1942. A new method of producing films on glass surfaces to reduce reflections is described. The glass is supported horizontally over a tray of circulating one per cent. hydrofluoric acid solution, the action of the acid vapour on the glass resulting in the formation of a film of calcium fluoride. This reduces visible reflections to 6-10 per cent. of that of untreated glass surfaces. Uses suggested include treatment of lenses to obtain higher transmission, and reduction in reflection from shop windows and picture glass. W. E. H.

84. The Fatigue Effect in Luminescent Materials. N. C. Beese, J. W. Marden. Jour of Opt. Soc. of America, Vol. 32, 6, June, 1942. Describes experimental work carried out to measure the amount and duration of fatigue effects in luminescent materials when exposed to high intensities of 3650A and 2537A ultra-violet radiation. The influence of temperature on the fatigue effect is also considered. H. J. T.

85. Anodic Protection of Aluminium and its Alloys. Anon. Elec. Times. Vol. 102, 2653, Aug. 27, 1942. A detailed description is given of various processes for "anodising" aluminium. A section is devoted to the treatment of reflectors



You need never lose your direction on a starry night if you learn to recognise a few of the principal "constellations" or groups of stars.

The constellation emphasised above and familiarly known as the "Plough" includes seven prominent stars, two of which act as "pointers" towards the Pole Star, which lies directly above the Earth's North Pole and is a fixed point round which the entire stellar system, including the Plough, appears to revolve slowly from East to West (once every 23 hours 56 minutes).

Although the position of the Plough, as it revolves around the Pole Star, depends on the date and time of day, you will have no difficulty in recognising it and locating the Pole Star by means of the 'pointers."

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SOURCES OF LIGHT

85. Fluorescent Lamps. L. J. Davies, H. R. Ruff, W. J. Scott. Jour. Inst. Elec. Engrs., Vol. 89, Part I., 18, June, 1942. A paper describing the history, principles, and physical and electrical characteristics of main voltage fluorescent lamps. H. J. T.

87. Fluorescent Lamps. Editorial. Elec., 129, p. 132, Aug. 7, 1942. A brief account is given of the use of fluorescent lamps for the lighting in an exhibition of war photographs. C. A. M.

88. New 13.6 mm. Carbons for Increased Light Output. M. T. Jones, W. W. Lozier, D. B. Joy. J. Soc. Mot. Pict., Eng., Vol. 38, p. 229, March, 1942. Describes a new super-carbon burning 170 amperes with a consumption of 22 inches per hour, giving 20 per cent. more light on the screen than the previous 180 ampere type. R. G. H.

89. Germicidal Lamps. Matthew Luckiesh, L. L. Holladay. Elect., 129, pp. 219-222, Aug. 28. 1942. Some results are given of experiments by the authors in the design of installations of germicidal lamps for occupied rooms. C. A. M.

APPLICATIONS OF LIGHT

90. Modern Lighting Practice. Anon. Am. Illum. Eng. Soc. Trans., pp. 271-274, May; pp. 343-346, June, 1942. Some representative lighting schemes are described with photographs. J. S. S.

91. Present Day Seeing Requirements —Footcandles. W. Sturrock. Am. Illum. Eng. Soc. Trans., pp. 347-357, June, 1942. The increase in illumination levels over the last twenty years is analysed. J. S. S.

92. Lighting Tendencies. Anon. El. Rev., Vol. 130, p. 525, April 24, 1942. Factory lighting practice in America is discussed. The almost universal adoption of the tubular fluorescent lamp is the most prominent feature. R. G. H.

93. American Recommended Practice of Industrial Lighting. Committee on Industrial Lighting. Am. Illum. Eng. Soc. Trans., pp. 279-321, May, 1942. The requirements of satisfactory lighting and recommended values of illumination are set out. Methods of lighting, maintenance, and wiring are discussed. J. S. S.

94. How to Keep the Blackout Out. Myrtle Fahsbender. El. World, 117, p. 2062, June 13, 1942. Various methods are discussed for providing blackout of windows in the home, while maintaining a cheerful appearance in the rooms at little cost. The question of providing ventilation is also considered; and some things to avoid are listed. S. S. B.

95. Practical Blackout Lighting for Factories. Ward Harrison. El. World, 117, p. 2054, June 13, 1942. Various methods are considered for providing lighting in industrial buildings in America without the necessity of a separate blackout lighting system under the requirements now in force in America. S. S. B.

96. Don't be Caught with Your Lumens Down. P. R. Holmes, H. W. Conklin. Am. Illum. Eng. Soc. Trans., pp. 358-368, June, 1942. Problems of depreciation are discussed in detail. J. S. S.

97. Steelworks Lighting. M. C. Toner. El. Rev., Vol. 130, p. 699, May 29, 1942. The author points out that those parts of steelworks where rolling, smelting, and forging are carried out are exempt from Regulation 2 (a) of the Factories (Standards of Lighting) Regulations, 1941. Under blackout conditions there are violent changes in lighting levels between operations. Cases of accidents are increasing and have been attributed to bad lighting. R. G. H.

MISCELLANEOUS

98. Recommended Practices of the Society of Motion Picture Engineers. Anon. J. Soc. Mot. Pict. Eng., Vol. 38, p. 403, May, 1942. Summarises present-day practice of the S.M.P.E. The integrating sphere is the primary standard of density measurement. The screen brightness is 10, +4 or −1, e.f.c. when the projector is running, with no film in the gate. A standard photographic density is described, giving details of the filter solution and method of preparing the density. R. G. H.

99. Report of the Studio Lighting Committee. Anon. J. Soc. Mot. Pict. Eng., Vol. 38, p. 281, March, 1942. Details recent advances in motion picture lighting practice. Exposure meters are now being used to a greater extent than formerly. The newer types of arc are being found equally suitable for black-and-white and for colour work, and hence equipment can be made of more general use in studios using both media. R. G. H.